

### REMARKS

Claims 1-32, 37, 53 and 54 have been cancelled. New claims 74 and 75 have been added. Claims 33-36, 38-52 and 55-75 remain pending in this application. Reexamination and reconsideration of the claims is respectfully submitted.

Applicants wish to thank the examiner, Mr. Ingham, for the courtesy of conducting a personal interview with the undersigned attorney on March 16, 2010. The issues discussed at the interview are summarized below. In particular, the below remarks explain why the proposed combination of Elliott and Taylor would not and could not perform the functions recited in the claims.

Claims 33-37, 39-42, 44, 46, 48, 50-52, 56-58, 60-67, 69 and 71-73 were rejected under 35 U.S.C. 103(a) as being unpatentable over Taylor (USP 6,803,557) and Elliott (USP 5,016,073). Claims 43, 47, 49, 55 and 59 were rejected under 35 U.S.C. 103(a) as being unpatentable over Taylor, Elliott and Johnson (IDS filed 24 Sept. 2007, Journal of Applied Physics, volume 80, pages 1116 - 1127).

These rejections are respectfully traversed.

Elliott teaches a narrow bandgap photon absorbing layer sandwiched between two semiconductor layers having larger effective bandgaps. Elliott's photon absorbing layer has very low doping, and part or all of it is depleted by a neighboring layer of opposite majority carrier type.

Taylor also teaches a photon absorbing layer which is depleted. In Taylor's case the region of the photon absorbing layer that contributes a signal must be fully depleted for the device to work.

The presence of a depletion region in the photon absorbing layer of both references ensures that the dark current is limited by a Generation-Recombination (GR) current, which is much larger than a diffusion current. Stated somewhat differently, if Taylor and Elliott were combined as proposed the result would be a device in which the dark current is not "essentially diffusion limited" (as required by the current claims) but which is instead GR limited. In

addition, the proposed combination of Taylor and Elliott would fail to produce a two heterojunction device in which the energy bandgap of the middle barrier layer (between the two heterojunctions) has the widest bandgap (as required by the claims, which recite, for example, “the energy bandgap of the n-type photon absorbing layer being narrower than the energy bandgap of the middle barrier layer”). The present claims require a larger bandgap in the middle layer to suppress tunneling, so that the tunnel current across the two heterojunctions (i.e. from the contact layer to the photon absorbing layer) will be very small. A similar result would not be achieved by the proposed combination of Taylor and Elliott.

Moreover, if Taylor and Elliott were combined as proposed, the resulting combination would fail to (i) prevent creation of a depletion region in the photon absorbing layer when a bias voltage is applied across the heterostructure (ii) cause a tunnel current of electrons from the contact layer to the photon absorbing layer which is less than a dark current in the photo-detector, (iii) cause the dark current from the photon-absorbing layer to the barrier layer to be essentially diffusion limited, or (iv) reduce the generation recombination (GR) noise of the photo-detector.

Applicants further submit that the combination of Taylor and Elliott fails to render the present claims obvious for at least the following additional reasons.

First, the prior art fails to explain how or why Taylor’s homojunction can be removed and replaced by Elliott’s heterojunction to give the properties defined by the present claims. Taylor teaches a homojunction. Elliott teaches a heterojunction. A proper obviousness rejection requires a prior art explanation of how and why a skilled person would remove Taylor’s homojunction and replace it with Elliott’s heterojunction to make the claimed dual heterojunction device. The prior art fails to provide such explanation. Instead, the prior art teaches that Elliott’s heterojunction can be removed and replaced by a homojunction giving properties similar to Elliott’s heterojunction. There is no prior art teaching that explains how and why Taylor’s homojunction can be removed and replaced with Elliott’s heterojunction to give properties similar to Taylor’s homojunction.

In other words, the prior art teaches removing and replacing a heterojunction with a homojunction that has properties similar to the removed heterojunction. The prior art fails to teach removing and replacing a homojunction with a heterojunction that has properties similar to the removed homojunction. The prior art fails to teach removing and replacing a homojunction with a heterojunction that has properties similar to those defined by the present claims.

Second, and more importantly, Elliott teaches a device having that is structurally and functionally different from the present claims. Elliott discloses a so-called "Elliott device." This is the type of prior art device that is described and distinguished at paragraphs 0018-0021 of the present application.

As described at paragraphs 0018-0021, Elliott is structurally different from the device defined by the present claims. Elliott teaches a narrow bandgap semiconductor, clad on each side by an n-type and a p-type semiconductor respectively, each with a larger effective bandgap. In contrast, the present claims define a device having a wide bandgap semiconductor sandwiched between n-type and p-type semiconductors with similar or narrower bandgaps. A structure similar to that defined by the present claims is neither disclosed nor suggested by Elliott.

As described at paragraphs 0018-0021, Elliott is functionally different from the device defined by the present claims. Elliott teaches reduction of the dark current by suppression of Auger-related generation processes. Elliott fails to teach or suggest suppressing G-R currents, even at room temperature. In contrast, the present claims define a device in which the level of the G-R current is significantly suppressed in a given temperature. A device exhibiting similar properties is neither disclosed nor suggested by Elliott.

Consequently, even if Elliott was combined with Taylor as proposed, the resulting combination would be structurally and functionally different from the present claims. In this respect the present case is clearly distinguishable from the case of *KSR International Co. v. Teleflex Inc.*, 82 USPQ2d 1385 (2007). In the present case, in contrast to *KSR*, the structure defined by the present claims is different from the structure taught by either Taylor or Elliott and exhibits properties that are neither taught nor suggested by Taylor or Elliott. In particular, the

claimed combination significantly suppresses the level of G-R current at a given temperature. This result is neither taught nor predicted by Taylor or Elliott.

It is respectfully submitted that the motivation for the proposed combination of Taylor and Elliott comes only from the present claims, not from the prior art. A skilled person would not have found it obvious to selectively pick and choose separate elements and concepts from Taylor and Elliot, then fundamentally modify those elements so as to arrive at the claimed combination, without using the present claims as a guide. Such hindsight reconstruction of the claimed combination is not a proper basis for determining obviousness. There must be some reason or explanation in the prior art for selecting, modifying and combining the elements as proposed, other than the knowledge learned from the applicants' disclosure. *Interconnect Planning Corporation v. Feil*, 227 USPQ 543, 551 (Fed. Cir. 1985). It is respectfully submitted that no reason or suggestion for the proposed combination can be found in any of the cited and applied references.

The fundamental deficiencies with the primary references of Taylor and Elliott are not compensated by the additional reference of Johnson.


New claims 74 and 75 are similar, in some respects, to pending claims 33 and 50. No new matter has been added. Applicants submit that new claims 74 and 75 are patentable for at least the reasons discussed above with respect to claims 33 and 50.

In light of the above, a Notice of Allowance is solicited.

In the event that the transmittal letter is separated from this document and the Patent and Trademark Office determines that an extension and/or other relief is required, applicants petition for any required relief including extensions of time and authorize the Commissioner to charge the cost of such petitions and/or other fees due in connection with the filing of this document to **Deposit Account No. 03-1952**, referencing Docket No. **266722000300**.

Respectfully submitted,

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By:   
Alex Chartove  
Registration No. 31,942  
Morrison & Foerster LLP  
1650 Tysons Boulevard, Suite 400  
McLean, VA 22102-3915  
Telephone: (703) 760-7744  
Facsimile: (703) 760-7777